Docket No. 60,130-1853
02MRA0222

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Coleman, et al.
Serial No.:	Herewith
Filed:	Herewith
Examiner:	Unknown
Group Art Unit:	Unknown
For:	ACTUATOR ASSEMBLY

TRANSMITTAL OF CERTIFIED COPY

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

With regard to the above-referenced patent application, enclosed is a Certified Copy of United Kingdom Application Number (GB) 0217665.9 filed 31 July 2002, from which priority is claimed pursuant to 35 U.S.C §119.

Respectfully submitted,

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Dated: July 30, 2003

Docket No. 60,130-1853
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CERTIFICATE OF EXPRESS MAIL

I hereby certify that the enclosed Transmittal of Certified Copies are being deposited with the United States Postal Service as Express Mail "Post Office to Addressee," postage prepaid, in an envelope addressed to Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 on July 30, 2003.

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The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

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Dated 2 June 2003

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31JUL02 E737319-3 001038
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The Patent Office
Cardiff Road
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1. Your reference P303181GB/JBJ P47902/000

2. Patent application number
(The Patent Office will fill in this part) 0217665.9 31 JUL 2002

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

ArvinMeritor Light Vehicle Systems (UK) Limited
Fordhouse Lane
Stirchley
Birmingham
West Midlands
B30 3BW
United Kingdom

Patents ADP number *(if you know it)* 8411480001

If the applicant is a corporate body, give the country/state of its incorporation: United Kingdom

4. Title of the invention: Actuator Assembly

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

WITHERS & ROGERS
Goldings House
2 Hays Lane
London
SE1 2HW

Patents ADP number *(if you know it)* 1776001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(answer 'Yes' if:*
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
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YES

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	6
Claim(s)	3
Abstract	
Drawing (s)	1 + 1

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Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	One
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature J & K Date 30/7/02

12. Name and daytime telephone number of person to contact in the United Kingdom — John B Jones — 0121 245 3900

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Notes

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P303181GB

Actuator Assembly

The present invention relates to actuator assemblies, in particular to actuator assemblies used to release or latch vehicle door latches.

Known actuator assemblies when used in vehicle door latches are only required to provide an output in one direction when actuating. The actuator assembly is returned to a rest position by powering an actuator assembly motor in a reverse direction. This return stoke does no work.

Our copending application EP1128006 exploits the fact that the return stroke can be used to do work and includes a form of energy storage means, for example a spring, arranged to store energy when the actuator is moving in a return direction, and assist the actuator when moving in the actuation direction. This allows the actuator to produce a higher output force in the actuation direction, or indeed allow a smaller actuator motor to be used for the same output force.

However, a problem with such an actuator assembly relates to the fact that once the energy has been stored in the spring, some form of retaining means is required to releasably retain the actuator in a rest position, thereby preventing the spring from driving the actuator in the actuation direction when actuation is not required.

This problem is overcome in EP1128006 by using retaining means such as a clutch or detent arrangement which is arranged in the actuator assembly so as to prevent the spring from driving the actuator. However, this requires the actuator assembly to include additional components and adds to the complexity of the assembly.

In some situations, the friction associated with the actuator assembly itself and/or friction associated with the components to be actuated is sufficient to overcome the energy stored in the spring, and therefore prevent the spring from driving the actuator in the actuation direction. However, relying on such friction tends to limit the force of the spring which can be used.

An object of the present invention is to provide an actuator assembly which is powered in an actuation direction and in a return direction (to store energy in an energy storage means) which is less complex.

According to the present invention there is provided an actuator assembly including an actuator drivingly connected by a transmission path to an output member, the actuator being capable of moving the output member about a pivot point in a first direction from a rest position of the actuator assembly to an actuated position, and also being capable of moving the output member in a second direction from the actuated position to the rest position, the assembly further including an energy storing means which provides a force, movement of the output member by the actuator in the first direction being assisted by the energy storing means and movement of the output member in the second direction by the actuator storing energy in the energy storing means, in which the energy storing means is positioned relative to the pivot point such that in the rest position, the force acts substantially through the pivot point so as to not generate any substantial resultant torque on the output member.

Advantageously this means that since there is no resultant torque acting on the output means, the output means remains in the rest position and therefore prevents the energy storing means from driving the actuator until actuation is required.

According to another aspect of the present invention there is provided an actuator assembly including an actuator drivingly connected by a transmission path to an output member, the actuator being capable of moving the output member about a pivot point in a first direction from a rest position of the actuator assembly to an actuated position, and also being capable of moving the output member in a second direction from the actuated position to the rest position, the assembly further including an energy storing means which provides a force, movement of the output member by the actuator in the first direction being assisted by the energy storing means over a substantial portion of the movement to the actuated position and movement of the output member in the second direction by the actuator storing energy in the energy storing means over a substantial portion of the movement to the rest position,

in which the energy storing means is positioned relative to the pivot point such that in the rest position, the force acts to drive the output member in the second direction.

Advantageously this means that in the rest position the energy storing means drives the actuator in the second direction, and therefore prevents the energy storing means from driving the actuator until actuation is required.

The invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a view of an actuator assembly according to the present invention with the actuator in a rest position, and,

Figure 2 is a view of the actuator assembly of figure 1 with the actuator in an actuated position.

With reference to figure 1 there is shown an actuator assembly 10 including a housing 13 (only part of which is shown), an actuator in the form of an electric motor 12, an output member in the form of a worm wheel 16, and an energy storing means in the form of a helical spring 18.

The worm wheel 16 is rotationally mounted on the housing 13 at pivot 28, and includes an abutment in the form of a crank pin 30. The worm wheel is further connected by means (not shown) to a device which is required to be actuated.

The helical spring 18 is mounted on the housing 13 and has a circular portion 26 including several coils mounted on boss 26A of housing 13. Spring 18 also includes a first arm 20 and a second arm 22. The first arm 20 abuts against the crank pin 30, and the second arm 22 abuts against a fixed abutment 24 which is mounted on the housing 13. The spring 18 thus acts to bias crank pin 30 away from fixed abutment 24.

The electric motor 12 is drivingly connected to the worm wheel 16 by the worm gear 17. The worm gear 17 is mounted rotationally fast on electric motor shaft 15 and engages with the worm wheel 16 via gear teeth (not shown).

It can be seen from figure 1 that the worm gear 17 and electric motor shaft 15 form a transmission path 14 between the electric motor 12 and the worm wheel 16, such that actuation of the electric motor 12 causes the worm wheel 16 to rotate about pivot 28.

The actuator assembly preferably includes a stop means (not shown) operable to prevent movement of the worm wheel 16 anticlockwise past the position shown in figure 1.

The actuator assembly also preferably includes a further stop means (not shown) operable to prevent movement of the worm wheel 16 clockwise past the position shown in figure 2.

Operation of the actuator assembly is as follows:

Figure 1 shows the actuator assembly in a rest position with helical spring 18 having been wound up (see below). With the crank pin 30 in position A, the first arm 20 generates a force F which acts on the crank pin 30 in a direction which acts through pivot 28. Thus the force generated by the helical spring 18 does not generate a resultant torque on the worm wheel 16.

It will be appreciated that when the force acts substantially through pivot 28, the actuator assembly will remain stationary, and this is independent of any friction forces is the actuator or friction associated with the components to be actuated.

When actuation is required, an electrical current is supplied to the motor 12 resulting in shaft 15 rotating and consequently worm wheel 16 rotating in a first (actuating) direction (clockwise when viewing figure 1) towards the actuated position of figure 2. As the worm wheel 16 rotates, crank pin 30 moves in the first direction from position A of figure 1 to position C of figure 2, the movement being assisted by the force provided by the helical spring 18 which is acting on the crank pin 30 and therefore the worm wheel 16.

Once actuation has occurred, an electrical current is supplied to the motor 12 which causes it to run in a reverse direction, and results in the worm wheel 16 rotating in a second (return) direction (anticlockwise direction when viewing figure 2) towards the rest position of figure 1. This results in crank pin 30 moving from position C of figure 2 to position A of figure 1. It will be appreciated that as the worm wheel 16 moves in the second direction it works against the helical spring 18 which is being acted on by the crank pin 30, and causes the helical spring to wind up.

Thus when the actuator assembly is moving in the first (actuating) direction from its rest position to its actuated position the helical spring 18 is unwinding and thus releasing energy previously stored and assists the motor 14. When the actuator assembly moves in the second (return) direction from its actuated position to its rest position, the motor 12 acts to wind up, and therefore store energy in, the helical spring.

It will be appreciated that as the worm wheel 16 rotates in the first direction, the crank pin 30 will firstly slide along arm 20 towards the circular portion 26 of the helical spring before reaching its closest position following which it will slide back along arm 20 away from the circular portion 26.

In a further embodiment, the arm 18 can be locally fixed to abutment 24 such that no sliding occurs. Similarly the arm 20 can be locally fixed to pin 30 so no sliding occurs. Under these circumstances boss 26A can be dispensed with so as to allow the circular portion to float in space, as determined by the movement of arms 18 and 20.

Once the actuator assembly has been returned to its rest position by the motor 12 as shown in figure 1, the helical spring 18 acts on the crank pin 30. However, as described above, the force acting on the crank pin 30 acts substantially through the pivot 28, and thus the actuator assembly remains in the rest position until further current is supplied to the motor 14.

Even though the spring is unwinding when moving from the position shown in figure 1 to the position shown in figure 2, depending upon the geometry and spring rate, the torque applied to worm wheel 16 can be arranged to start at zero, increase to a maximum and then decrease (in some cases back to zero) as the actuator moves from its rest to its actuated position. This has the advantage that the actuator only has to produce a relatively low torque when starting to return. The higher torque only being required on the return strokes once the motor is in motion.

Referring back to figure 1 is an alternative embodiment, the crank pin is shown in rest position B. In this case the preferred stop means (not shown, but mentioned above) would be repositioned to allow the worm wheel to rotate this far anticlockwise.

The operation of the actuator assembly differs from when the crank pin is stopped at position A since, in the rest position, the force acting on the crank pin 30 no longer acts substantially through pivot 28, but sufficiently offset from the pivot so as to generate a torque on the worm wheel and drive the worm wheel in the second (return) direction.

As the worm wheel is driven by the motor in the first direction from the rest position (position B), the crank pin firstly passes through position A before reaching the actuated position (position C) shown in figure 2. Therefore from position B to position A the motor is storing energy in the helical spring, whereas from position A to position C the motor is assisted by the helical spring. It should be noted that the angle that arm 20 rotates through between positions B and A is relatively small and hence only a relatively small amount of energy is stored in the spring when the crank pin moves from B to A. However the spring is significantly unwound when the crank pin moves from A to C thus releasing significant amounts of stored energy to assist the motor 12.

Thus, whether the crank pin is stopped at position A (first embodiment) or position B (second embodiment), the helical spring provides a force which either does not generate any substantial resultant torque on the worm wheel (position A), or drives the worm wheel in the second (return) direction (position B), and therefore the worm wheel is prevented from driving the motor in the first (actuating) direction unless actuated.

Claims

1. An actuator assembly including an actuator drivingly connected by a transmission path to an output member, the actuator being capable of moving the output member about a pivot point in a first direction from a rest position of the actuator assembly to an actuated position, and also being capable of moving the output member in a second direction from the actuated position to the rest position, the assembly further including an energy storing means which provides a force, movement of the output member by the actuator in the first direction being assisted by the energy storing means and movement of the output member in the second direction by the actuator storing energy in the energy storing means, in which the energy storing means is positioned relative to the pivot point such that in the rest position, the force acts substantially through the pivot point so as to not generate any substantial resultant torque on the output member.

2. An actuator assembly according to claim 1 in which the energy storing means is positioned such that the force acts through the pivot point of the output member.

3. An actuator assembly including an actuator drivingly connected by a transmission path to an output member, the actuator being capable of moving the output member about a pivot point in a first direction from a rest position of the actuator assembly to an actuated position, and also being capable of moving the output member in a second direction from the actuated position to the rest position, the assembly further including an energy storing means which provides a force, movement of the output member by the actuator in the first direction being assisted by the energy storing means over a substantial portion of the movement to the actuated position and movement of the output member in the second direction by the actuator storing energy in the energy storing means over a substantial portion of the movement to the rest position, in which the energy storing means is positioned relative to the pivot point such that in the rest position, the force acts to drive the output member in the second direction.

4. An actuator assembly according to any preceding claim in which the energy storing means acts on the output member.

5. An actuator assembly according to claim 4 in which the energy storing means acts on an abutment of the output member.

6. An actuator assembly according to claim 5 in which the abutment moves about the pivot point as the output member moves.

7. An actuator assembly according to claim 5 or 6 in which the abutment is a crank pin.

8. An actuator assembly according to any preceding claim in which the assistance provided by the energy storing means as the output member moves in the first direction progressively increases to a maximum and then decreases.

9. An actuator assembly according to any preceding claim in which the energy storing means is a resilient means.

10. An actuator assembly according to claim 9 in which the energy storing means is a spring.

11. An actuator assembly according to claim 10 in which the spring is a helical spring.

12. An actuator assembly according to claim 11 in which the helical spring includes a circular portion comprising one or more coils and at least one arm which acts on the output member.

13. An actuator assembly according to claim 12 in which the spring has a further arm which acts on a fixed abutment.

14. An actuator assembly according to any preceding claim in which the output member is a worm wheel and the transmission path includes a worm gear.

15. An actuator assembly according to any preceding claim further including a stop means, which acts to define the rest position.

16. An actuator as defined in any preceding claim including a further stop means which acts to define the actuated position.

17. An actuator assembly as herein before described with reference to or as shown in figures 1 and 2 of the accompanying drawings.

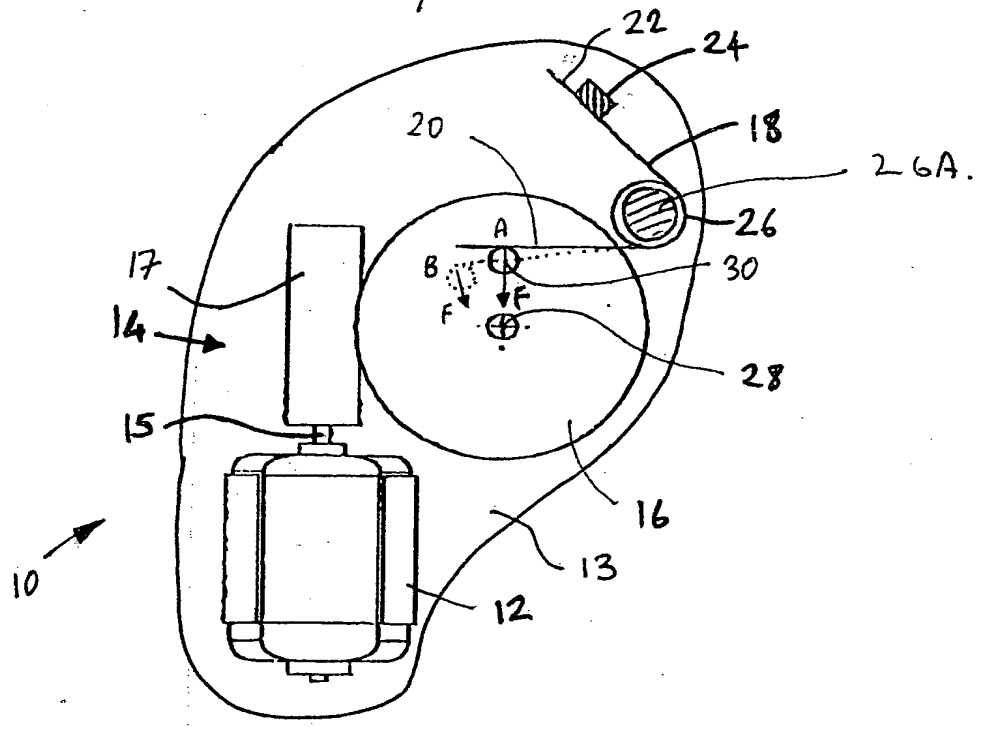

FIGURE 1

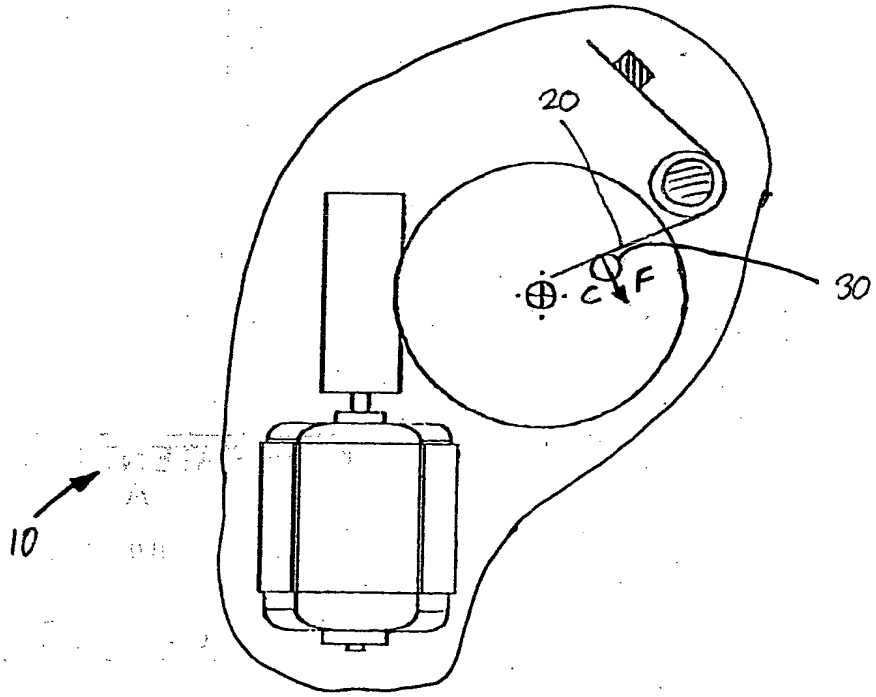

FIGURE 2